Environmental, Safety & Occupational Health

Lesson 22

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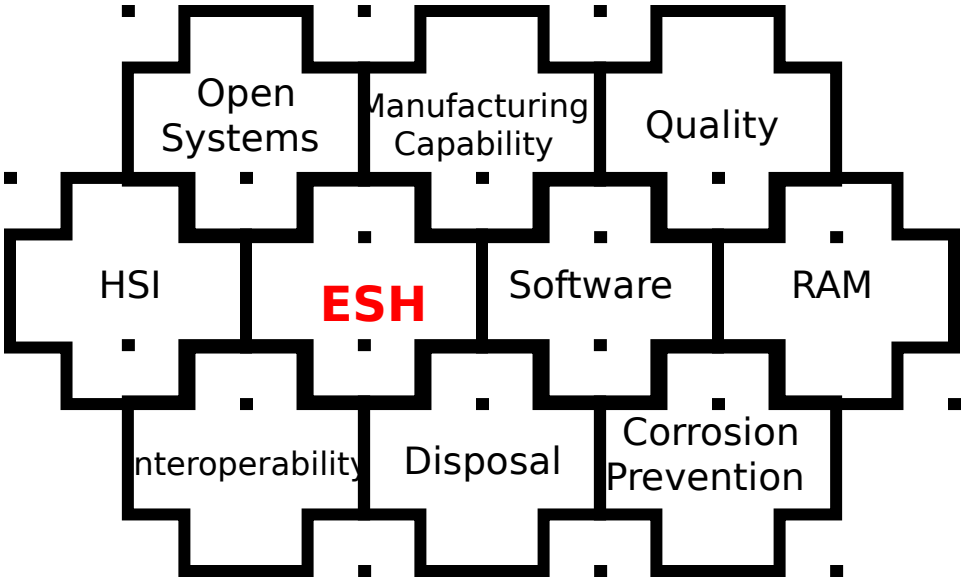
KEY LEARNING OBJECTIVES

#1 Balance integration of the three ESH topic areas as applied to PQM

#2 Integrate ESH considerations into the Systems Engineering process

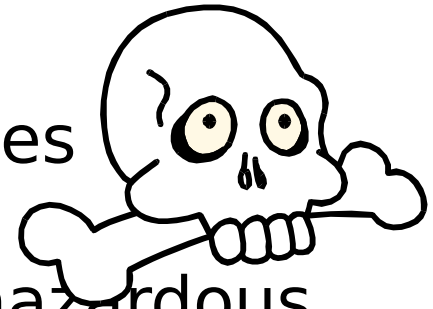
#3 Recognize how effective ESH Risk Management helps the User



ESH to **ESH**

Why Worry?

- Estimated cost to clean up DoD's current mess: $25 - $150 billion
  - 8,000 potentially contaminated sites at 900 military installations
  - DoD produces nearly 1 M tons of hazardous waste each year…more than top 5 industrial producers combined
  - 80% of DoD's hazardous wastes are from weapon systems operational support activities
- Cost of hazardous material versus cost to handle, treat, & dispose of waste is 1:80



ESH Realms

- Environment

  What program does to environment

  What environmental requirements do to program

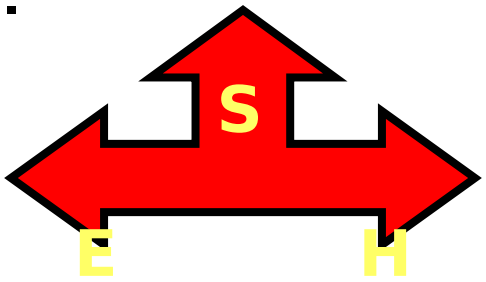
- Safety

  Examples include: system safety, software safety, explosives safety, laser safety, occupational safety, public safety, etc.

- Health

  Occupational health

  Community health



Impacts on Cost

- Health Risk Due to Toxicity of Material Requires:
  - Personnel Protective Equipment
  - Hazard Communication (Material Safety Data Sheets)
  - Medical Surveillance
  - Toxicity Assessment
  - Monitoring and Record Keeping
- System Safety Risks
  - Damage/losses due to accidents over the life cycle include:
    - Equipment
    - Personnel
    - Environment

How does the use of toxic materials drive costs?
How do System Safety risks impact life-cycle cost?

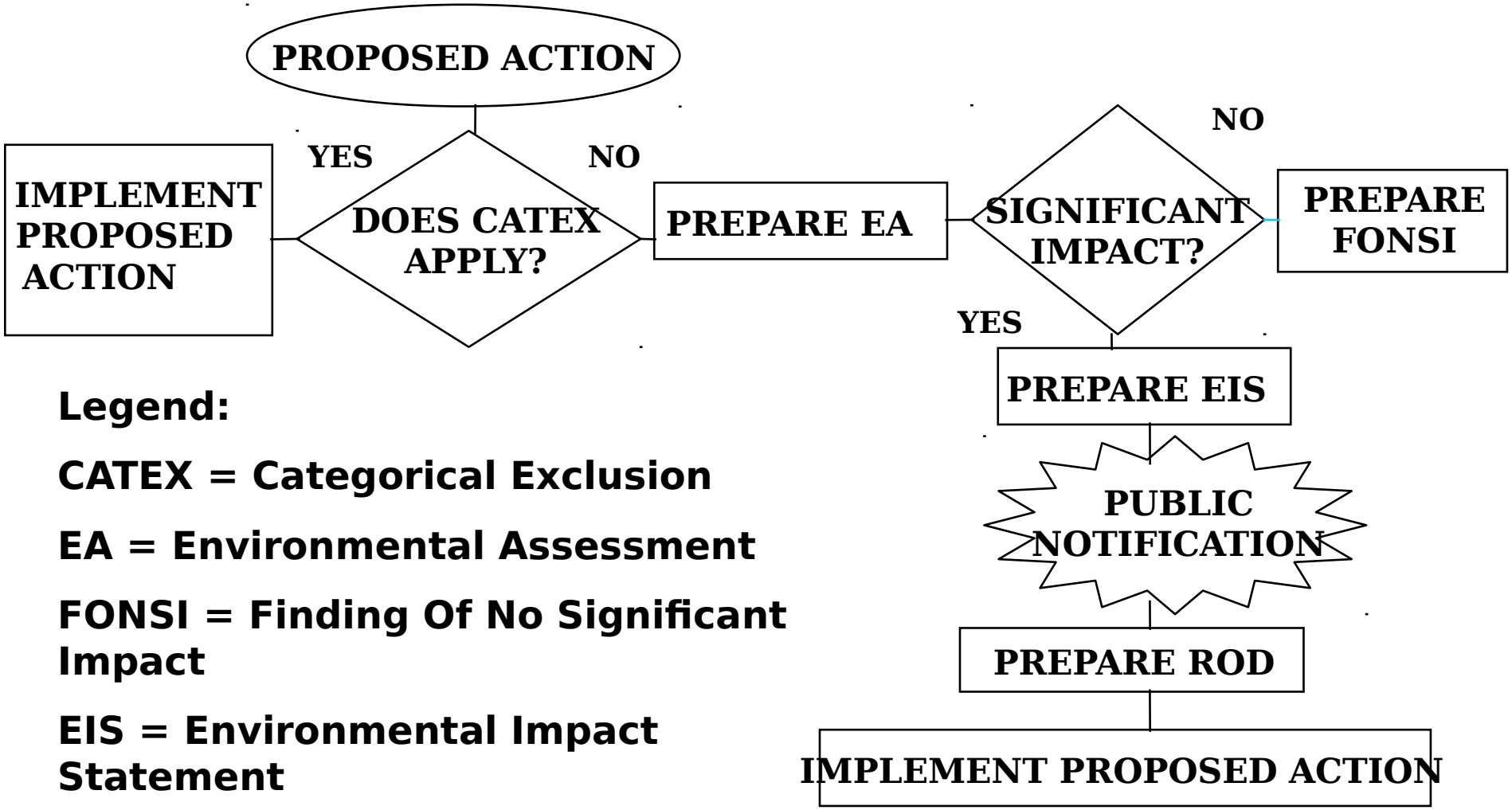
Impacts on Schedule

- ESH risk acceptance & approvals may delay or stop program during milestone reviews
- Production line delays for implementation of alternative materials and processes, regulatory shut down of depots, original equipment manufacturer’s (OEMs)/suppliers
- ESOH compliance requirements such as NEPA reporting can delay program

National Environmental Policy Act (NEPA)

- Prevent or reduce at source.
- Recycle if not prevented at source.
- Treat if not prevented or recycled.
- Dispose only as last resort.
- “Action-forcing” provisions
- Release of Environmental Information to Public, before decisions/actions

Typical NEPA Documentation Flow



Legend:

CATEX = Categorical Exclusion

EA = Environmental Assessment

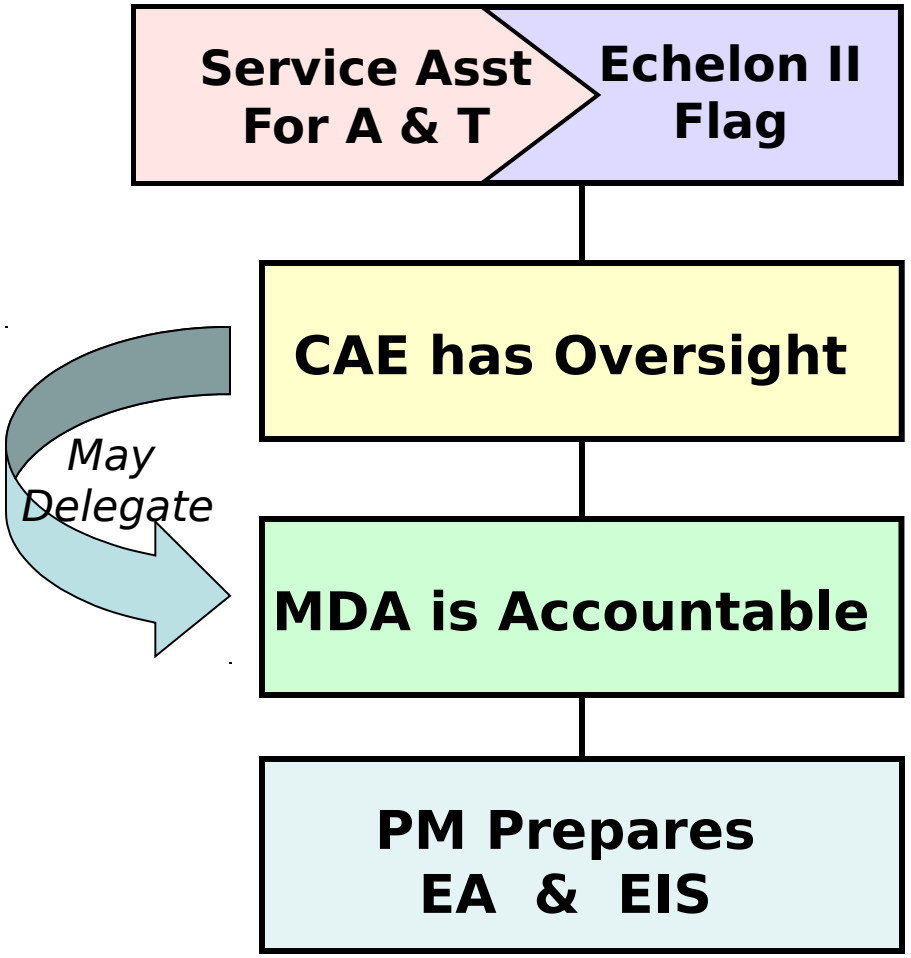
FONSI = Finding Of No Significant Impact

EIS = Environmental Impact Statement

ROD = Record Of Decision

Decision Path for EA/EIS

- **Comments resolved**
- **JAG Review for compliance**
- **Record of Decision Prepared**
- **Letter of Endorsement Signed**
- ***Federal Register* publication**



"The PM is Responsible"

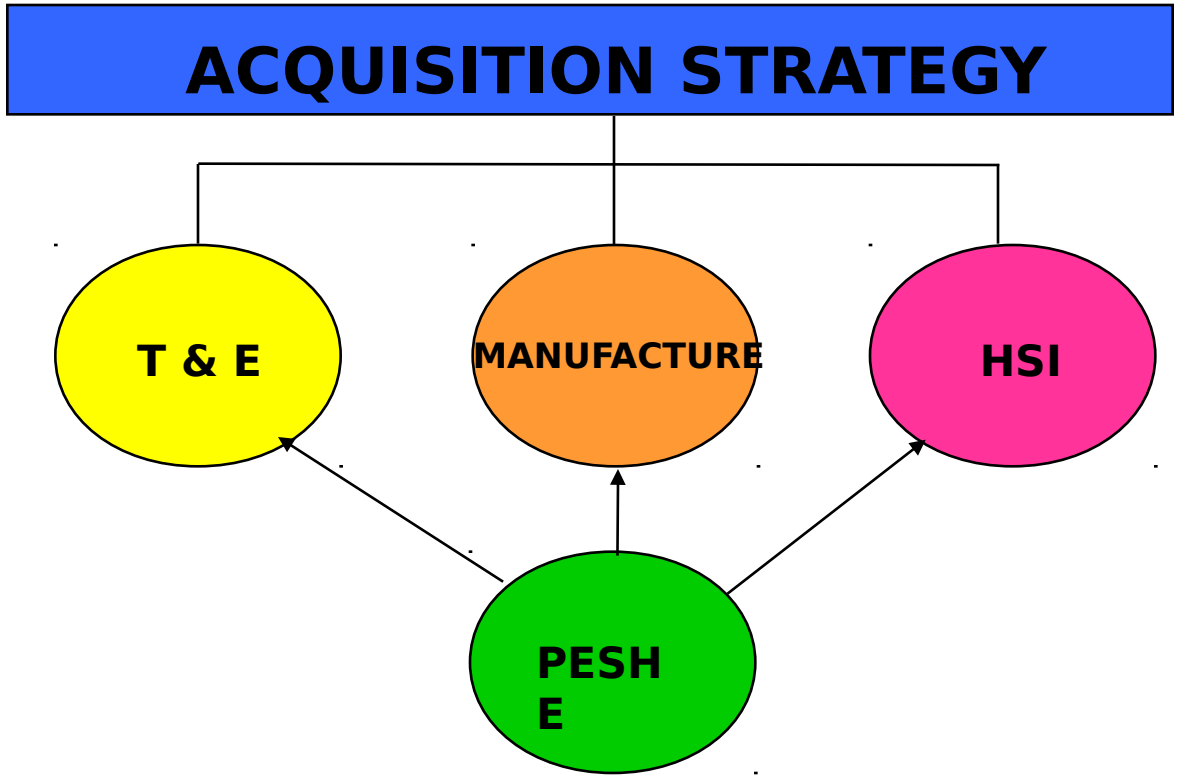
- **DAG**
- **5000.2**

Impacts on Performance

- Material decisions may result later in stiff regulation, higher costs to maintain, or lack of supply with no known alternatives
- Performance degradation, operational effectiveness impact
  - Solid-Propellant Rocket Motor Insulation
  - Halon 1301 Mission Critical Supply
- Improved performance and op readiness
  - New Technology, Industrial processes
  - Improved products, environmentally-preferred
  - Sustainable facilities

PESHE IS A FUNCTIONAL ANALYSIS

(It is a part of the Systems Engineering process)



FUNCTIONAL ANALYSES

RISK MANAGEMENT ISSUES

Programmatic: TOC, Schedule, Performance

Technical: ESH & other technical considerations

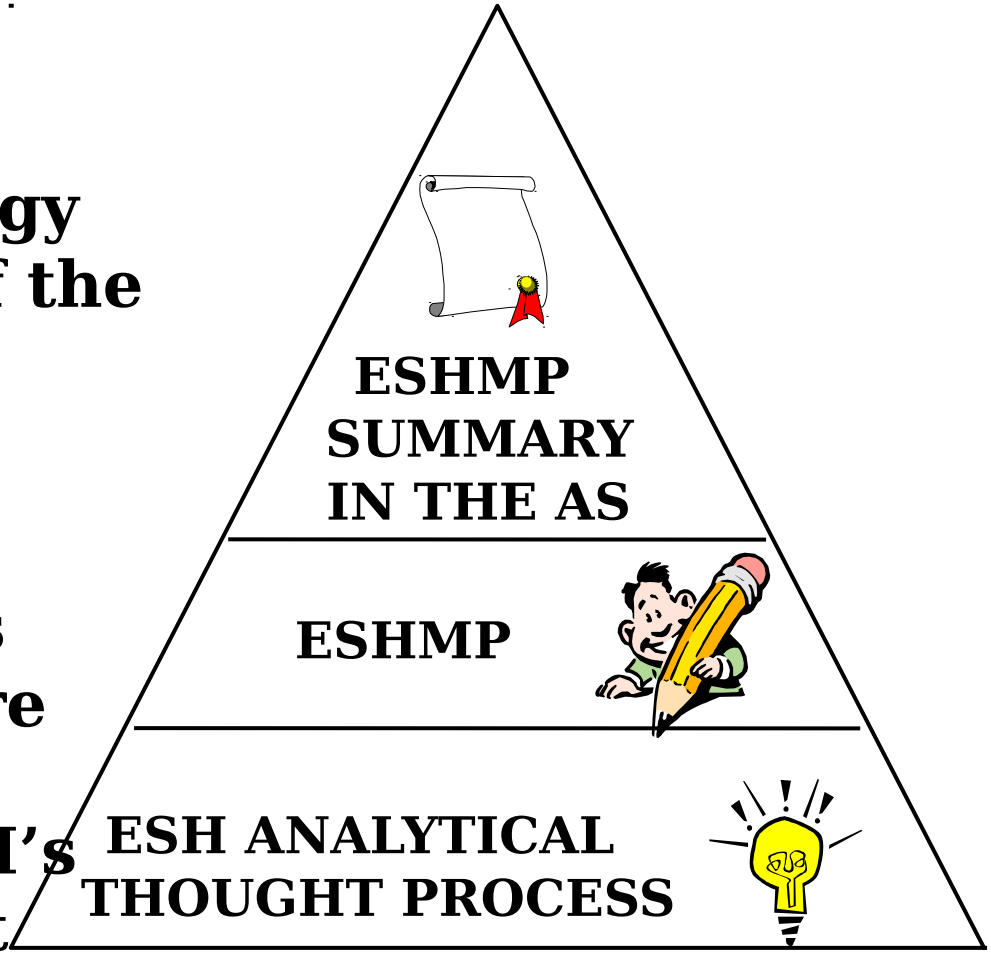
ESH: Compliance, NEPA, Safety/ Health, HazMats, P2, Explosives

The PESHE Process

The Acquisition Strategy contains a summary of the ESH Master Plan

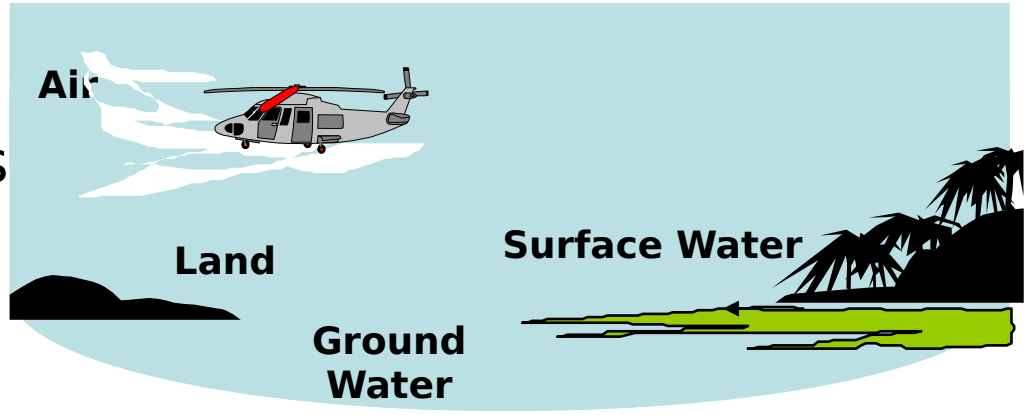
Think of "PESHE document" as the PM's ESH Master Plan, where the thought process is documented

The "PESHE" is the PM's ESH analytical thought process



Pollution Prevention

- Identify & quantify types & amount of pollutants
- Identify ESOH risks of using the system
- Minimize system impacts on the environment and human health, as well as environmental compliance impacts on program TOC
- Reduce the use of material which could be discharged or emitted to the environment or cause harm to human health through:
  - Product changes, alternative technologies
  - Process changes
  - Improved operating practices
  - Reuse, recycling



Hazardous Materials

AMC "BIG 3"
Army Materiel Command

- Ozone Depletors
  - Firefighting
  - Refrigerants
  - Solvents
- Heavy Metal Plating
  - Cadmium
  - Chromium
- Volatile Organic Compounds
  - Stripping
  - Cleaning
  - Painting

In your Text

EPA LIST of 33
Environmental Protection Agency

- Benzine
- Cadmium & Compounds
- Carbon Tetrachloride
- Chloroform
- Chromium & Compound
- Cyanides
- Dichloromethane
- Lead & Compounds
- Mercury & Compounds
- Methyl Ethyl Ketone
- Methyl Isobutyl Keyton
- Nickel & Compounds
- Tetrachloroethylene
- Toluene
- Trichloroethylene
- Xylene(s)

ASC PRIORITY LIST
Aeronautical Systems Center

- Group I Highest Priority:
  - Banned Materials (Asbestos, PCBs, OLDCs)
  - Last Resort (Hydrazine
- Gp II Reduce/Eliminate:
  - Chlorinated Hydrocarbons
  - VOCs (MEK, Benzine)
  - Heavy Metals & Compounds
  - Sensitizers
- Group III Consider Toxicit
  - Adv. Composite Mater Components

Hazardous Materials Management

- Evaluate and manage the selection, use and disposal of hazardous materials
  - Use alternate technology as becomes available
  - Select alternatives materials through changes in design, manufacturing or maintenance processes
  - Use National Aerospace Standard (NAS) 411 tenets
- Use HMM to integrate pollution prevention into the Systems Engineering Process
  - Identification/evaluation of hazardous materials
  - Compliance review
  - PESHE input
  - Trade-off analyses and documentation
  - Specialized training requirements
  - Review of specifications/standards
  - Alternatives selection and qualification testing
  - Documentation revisions

MIL-STD-882 System Safety Program

- Accepted Government standard by DoD and Industry
- Proven risk management analytical techniques and principles
- Provides common approach across program and contractors
- Provides common approach across other functional areas
- Can be used as a “yard stick” to evaluate offeror’s proposals

HAZARD and SAFETY

- Hazard: "A condition, event, or circumstance that could lead to or contribute to an unplanned or undesirable event."
  FAA Order 8040.4
- Safety: "Freedom from conditions that can cause death, injury, occupational illness, damage/loss of equipment or property, or damage to the environment."

Safety Hazard Mitigation Hierarchy

- Eliminate through design
- Reduce to acceptable level through design
- Reduce to acceptable level through external devices
- Reduce to acceptable level through warning devices
- Reduce to acceptable level through procedures and training

Material Safety Data Sheet

General Information

roduct: Coffee, Columbian
tended Use: Jump start students
hemical Family: Beanus Alertis

Physical Data

Boiling Point: 100 Degrees C
Appearance: Dark Brown
Odor: Vanilla
pH Levels: 4.5 to 5.0

Physical Data

Flash Point: N/A

Health & Hazard Information

May cause trembling & headaches. Some students have been found awake during a lecture!

Emergency First Aid

Give students large quantities of viewgraphs and flush with lots of cold water.

Reactivity Data

Stability: Stable under normal conditions. Cream & sugar will caus pH to increase.

Special Precautions

Protective Equipment: Tums

Applicable Laws

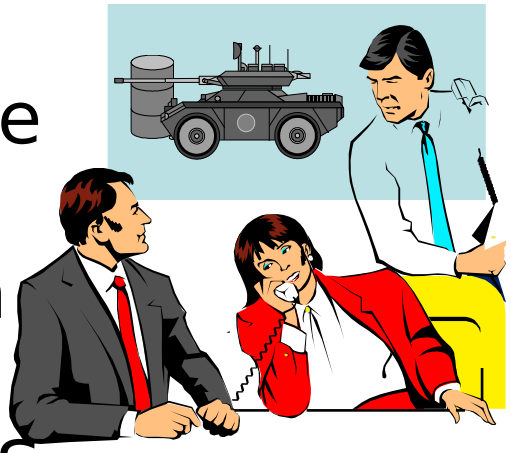
CWA **TSCA** **CERCLA**

Material Safety Data Sheets (MSDS)

- Procedures on how to handle Hazardous Materials.
- B-2 program, over 6000 MSDS submitted.
- Paint stripping chemicals - 1500 Gallons of HM generated when stripping paint on large aircraft (i.e. B-52, B-1, etc.).

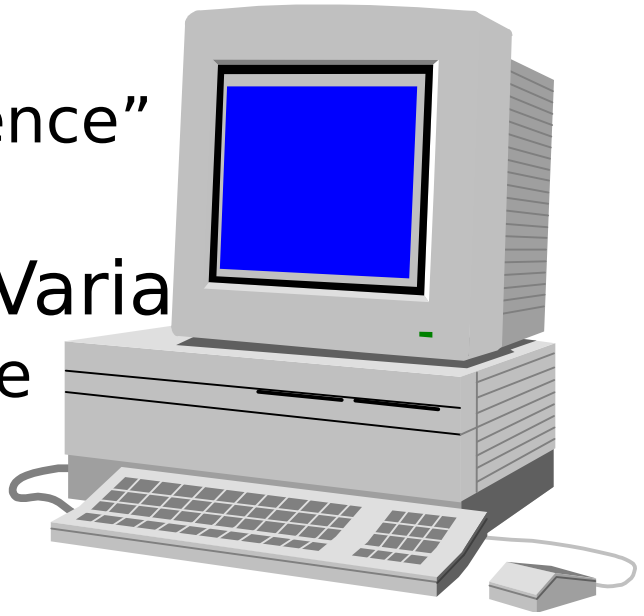
Trade-off Studies
Requirements and Logical Analysis

- Determine whether the material or process is critical to performance requirements or an alternative can be used. Based on whether material:
  - is being used
  - has no acceptable alternative
  - is a valid need
  - is available in supply system
  - has an operational impact
  - has regulatory impacts – O&S



Trade-off Studies
Life Cycle Cost (LCC) Analysis

- Aspect of Trade-off Studies
  - Determine HAZMAT cost drivers
  - Highlight affordable options
  - Rank feasible alternatives
- Why do LCC analyses?
  - Good business
  - PM: No more “Over the Fence”
  - Goal: Reduce TOC
- Cost As an Independent Varia
  - Acquisition reform principle
  - Cost constant variable



Trade-studies
Capture Lessons Learned

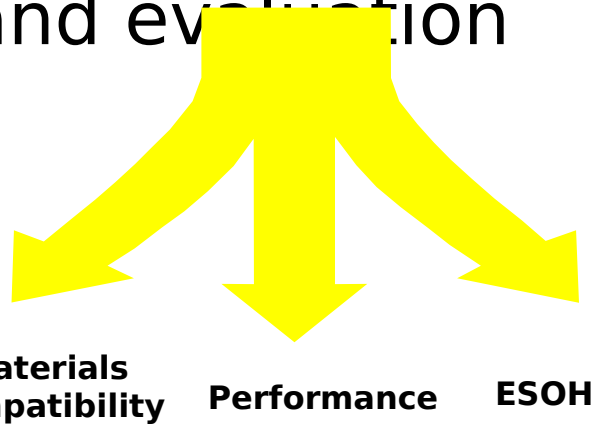
- PM should:
  - Perform post-deployment evaluations
  - Validate training material
  - Document lessons learned
  - Assess measures of quality
- Capture lessons learned from other programs
- Capture lessons learned from legacy systems

...Insert New Technologies...

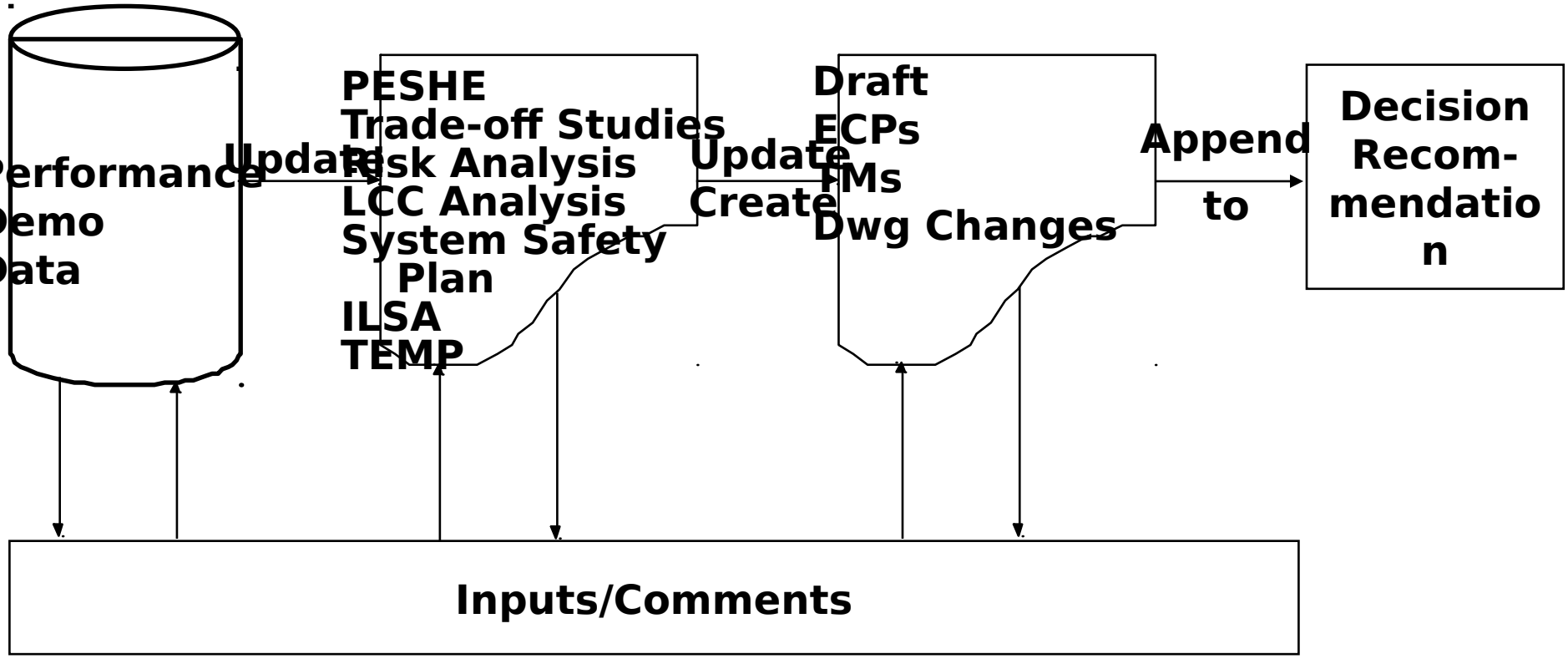
Test And Evaluate Selected Alternatives

"Prove It Works"

- Performance Testing: PM must ensure development of test protocols, and resources to conduct test and evaluation
  - Bench Test
  - Process Prototype
  - Field Test
- Why
  - Authenticate alternative meets performance
  - Need industrial environment acid test
  - Operator participation, acceptance (buy-in)



Document The Results “Make It Happen”



Possible Outcomes "What Happens Next"

- Change System/Subsystem/Component to Eliminate Need for HAZMAT
- Change System Documentation to Specify Alternative
- Change Lots of System Documentation to Implement Alternative Material/Process
- Continue Using Existing HAZMAT
  - Why...
  - How...
    - Ensure Controls Meet Compliance Standards
    - Implement HMMP (NAS 411)

In your Text

Outstanding Issues with the Requirements

- **New policies use “ESOH” vice “ESH” and are inconsistent with NEPA’s requirement to address health issues beyond OH**

- **ESH considerations before MS B not addressed; therefore no ESH-related technology risk reduction between MS A & B**

- **ESH now a subset of HSI requirements; but “E” not traditionally included in HSI**

- **PESHE listed in “Statutory Info Requirements” under NEPA; but NEPA (the law) makes no mention of the PESHE**

- **No clarification of PESHE process; therefore confusion over PESHE, PEHSE document, and PESHE summary**

- **ESH risk acceptance from the “industry standard” is required; but the policy and the standard are inconsistent in this area**

STATEMENT OF WORK (SOW)
STATEMENT OF OBJECTIVES (SOO)

- Hazardous Materials Management Program (HMMP)
  - Consideration over life cycle
- Consider prohibition of:
  - Class I ODSs (for all cases)
  - Class II ODSs (if service life goes beyond 2015)
- Limit to minimal use of:
  - EPA-33
  - Global warming substances
  - Others (Lithium, AFFF, DU, etc.)
- Include MIL-STD-882 requirements
- Include National Aerospace Standard (NAS) 411 tenets, Hazardous Material Management Program (HMMP)

Be sure to tailor specific task requirements!

REQUEST FOR PROPOSAL (RFP)

- Ask offerors to explain their approach to integrating ESH issues into their systems engineering process, to include:
  - Design
  - Test
  - Manufacturing
  - Operation & maintenance
  - Disposal
  - TOC impacts
- Include:
  - HMMP
  - Safety & health task deliverables
- Address offerors' TRI data
- Use Sections L & M to send our “message”

SEND THE CORRECT MESSAGE

- Section L, instruct the offerors to tell us:
  - How they will manage ESH hazards
    - Organization, expertise, integration
    - Their prioritization scheme
    - Identification, track & notify government
  - How they will manage HAZMATs (I.E., HMMP Plan)
  - How they will address life cycle
    - Costs
    - O&S issues
    - Disposal issues
- Section M, tell them what we will use to evaluate
  - MIL-STD-882 tenets - overall hazard management
  - NAS-411 tenets - HMMP Plan

WHAT TO LOOK FOR IN THE EVALUATION

- Does offeror understand how to manage ESH risks?
  - Already using MIL-STD-882 tenets
  - People - Integrates ESH experts into the design
  - Organization - Avoids stovepipes
  - Methodology - Identify, assess, mitigate, notify
- Does offeror understand what makes a good HMMP
  - Right mix of people, at right level of management
  - Integrated into systems engineering process
    - Design - manufacture - operation - support - disposal
  - Decisions based on:
    - Sound prioritization process (severity versus occurrence)
    - Life cycle considerations
    - Balanced ESH input
    - Total Ownership Costs (TOC)

PDR/CDR/PRR

- Identify pollution prevention opportunities and document in program documentation
- Review HMM efforts
- Identify HAZMAT use (baseline) and alternatives
- Define ESOH impacts from system
- Review waste disposal requirements
- Verify technical documentation changes

Coordinate with test, users and installation personnel during reviews to determine ESH requirements early and throughout the process.

Federal Agency Lessons Learned

- GAO estimates U.S. Clean-up equals S&L bail-out
- Legal liability protection to Industry may have been eroded
- Milestones lack sufficient information for informed decisions
- Safety hazards to test personnel has not always been minimized
- Noise levels are adversely impacting system fielding
- ESH-related LCC/TOC impacts have not always been identified
- Misconceptions over “grand fathering” new requirements exist
- Beryllium usage has seriously harmed employee health
- Some “Faster, Better, Cheaper” approaches resulted in problems
- Inadequate NEPA planning has impacted program testing

ESH Module Summary

- Challenge the program internally to institute ESOH
- Remain current on the drivers
- Understand how hazardous materials impact cost, schedule & performance
  - ESOH is a materials and processes issue – not an environmental issue!
- Conduct trade studies and use risk management to focus on ESOH issues throughout the life cycle
- Influence the procurement process – in RFP/SOO/etc.
- Document results – use PESHE, SEMP, TEMP as management tools to document your ESOH program
- Use the DESKBOOK as TOOL to determine requirements and obtain guidance
- Ask your service ESOH representatives for help

REMEMBER

The goal is to make the integration of ESH into the systems engineering process,

a thought process

rather than just an

afterthought!